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Hell and High Water 4

Indiana Jones and the Temple of Doom marks the second blockbuster association between executive producer George Lucas and director Steven Spielberg. Unlike *Raiders of the Lost Ark*, which—with the exception of its cosmic finale—relied primarily on dazzling stuntwork for its thrills and chills, many of the key sequences in the second Indiana Jones adventure were made possible only through the employment of elaborate visual effects. From miniature airplanes and mine cars to large-scale lava and water effects, the cinematographers of Industrial Light and Magic stretched the limits of their experience and expertise to produce some 140 effects shots for the consummate cliffhanger. Three-time Oscar-winning effects supervisor Dennis Muren discusses the project in detail, aided and abetted by numerous members of his highly-specialized team. *Article by Robert P. Everett.*

The Final Voyage of the Starship 'Enterprise' 42

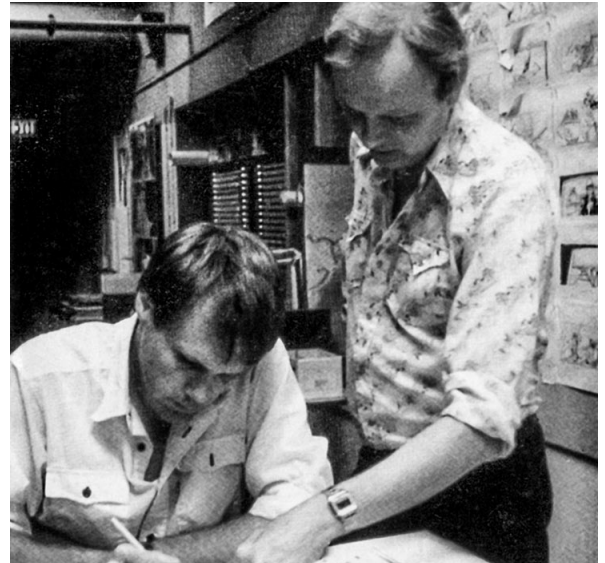
Concurrent with their involvement in *Indiana Jones*, the artists and technicians of Industrial Light and Magic were also at work on a vastly different project—their second foray into *Star Trek*'s final frontier. In *Star Trek III: The Search for Spock*, Oscar-winning effects supervisor Ken Ralston and his team were called upon to create alien creatures, several new spacecraft, a mammoth orbiting drydock, planetary surfaces for Genesis and Vulcan—and most memorably, the destruction of the starship *Enterprise*. Ralston and key members of the effects unit detail the challenges involved and the techniques employed in achieving these and other cinematic wonders. *Article by Brad Munson.*

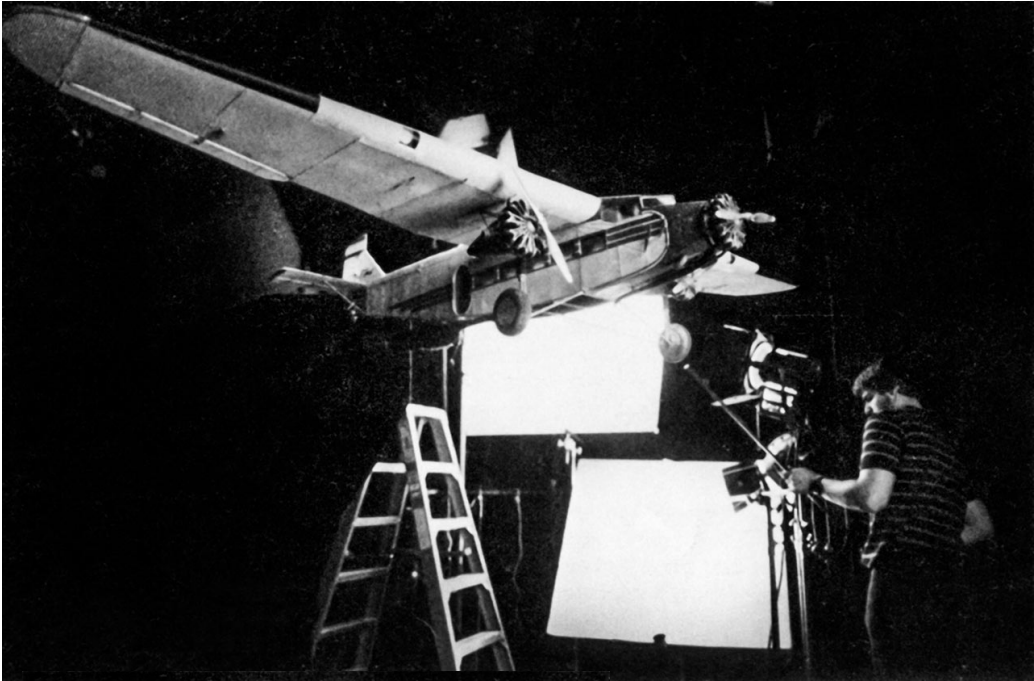
FRONT COVER — A human sacrifice in *Indiana Jones and the Temple of Doom*.
The *Enterprise* approaches the orbiting space dock in *Star Trek III* — BACK COVER.





CINEFEX 1







dissolved in over only its final moments.

With the Trimotor abandoned by its crew, Indy takes the controls—without a hint as to how to actually pilot it. A mountaintop looms up before him, and the aircraft's landing gear skims the snowy summit. "At first," said modelshop supervisor Lorne Peterson, "the plan was to have the mountain totally covered in snow, but by the time they got around to shooting the cockpit POVs somewhere up in the Sierras, a lot of the snow had melted. As a result, we had to build a miniature that looked pretty much the same. So up on the roof, we created a whole mountaintop with coal. You can get gigantic pieces of it—maybe two feet square—and hack away at it, and it has that really nice fractured look that granite has, but in smaller scale. So we built this mountain and then covered it with baking soda and microballoons. Then we rigged up a wire so that the plane would come in and just skim the top and the wheels would spin and the snow would fly. It was a pretty hot shot."

Suddenly aware that, on top of everything else, the Trimotor is also out of fuel, Indy and his companions have no alternative but to bail out—in an inflatable rubber raft. As the raft lands, plummeting them down a snowy hillside, the aircraft crashes into a mountain behind them. Originally, the three-foot miniature was to have been sacrificed. Fabricated from thin sheets of corrugated aluminum over an inner structure of brass, it had been given a deliberately weakened styrene nose section designed to collapse on impact. Upon further consideration, however, it was decided to build a second model half the size of the first in order to avoid a mountain-building project of major proportions. As it was, Peterson and his crew still had to construct a mountain range about twenty feet across by twelve feet deep.

Though the simplest approach would have been to rig a pair of wires and fly the small-scale Trimotor right into the mountain, Muren feared that after impact the wires might still hold up parts of the debris, ruining the shot. It was therefore decided to construct a five-foot-long pneumatic ram that would pull the plane into the mountain, crushing the fuselage and collapsing the wings. "In the beginning of the shot, we did use wires to fly the plane," said Muren, "but just before it hits, we jump-cut to the plane being pulled into the mountain by the ram. Since the plane was out of fuel, we didn't think it should explode on impact and so that's the way we shot it. Later though, after cutting the shot in, Steven and George thought it needed to explode in order to keep the action moving. By this time, however, it was too late to rebuild the set and restage the crash. So we went with what we had and optical matted in one of our stock explosions."

Ecstatic that they have somehow escaped unscathed, the unwilling tobogganers have time for only a quick sigh of relief before their raft shoots out over a cliff and down into a gorge

En route to the Trimotor, Indy passes China of the at the Ira K. Culver the n Drear Mure: minia sent i photo comp beca conc Jones Never outsi shot, suspe Mure: to he Came and s







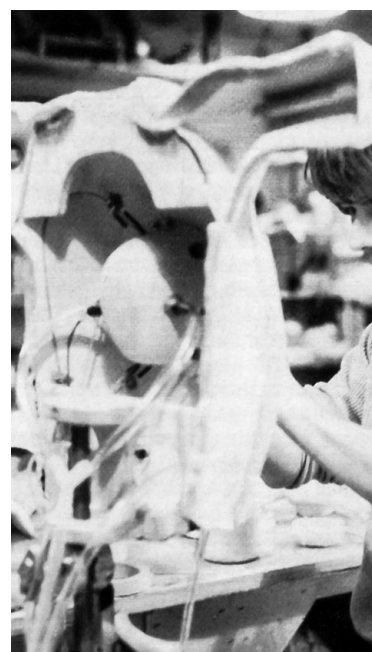
David Sosalla at work on a human torso for the scenes in which Mola Ram thrusts his hand into the chest of a sacrificial offering and pulls out his heart. / Joe Johnston and creative consultant Phil Tippett test the radio control mechanisms built into a half-scale replica of the same unfortunate victim. / A statue of Kali towers over the temple set constructed on stage at EMI Elstree. ILM recreated portions of it—the sacrificial cage and sliding doors in the floor—and also matted lava and steam effects into some of the master shots. / Kim Marks checks a camera angle as stage technicians prepare to actuate the miniature doors

teresting, because if you looked down, all you'd see was this little hole at the bottom. So we changed the design of the shot so that as you went down, the shaft opened up into a bigger chasm; and as you approached it, it got larger and larger and eventually filled the frame. As a result, what we ended up needing was a spiral of glycerine about twelve feet across."

Effects cameraman Mike Owens took on the overall problem-solving aspects of the lava vortex, working closely with assistant cameraman Kim Marks and members of the modelshop and stage crew. Charlie Bailey tackled the construction of the large-scale plexiglass vortex, while Paul Huston turned his attentions to the subterranean cave. The original plan, calling for only an inch-and-a-half to two inches of the glycerine substance, had to be revised early on. "Through testing," said supervising stage technician Patrick Fitzsimmons, "we found out that it had to be much deeper, and so we ended up with five to seven inches of the stuff. Underneath the plexiglass, we had probably fifteen 10K lamps blasting up with various colored gels depending on where the light was pointed—whether it was pointed at the center or at the side. To get the right effect, we had to pump the glycerine and the opaque stuff in at strategic places, and the amount going out had to be equivalent to the amount coming in to maintain a level so the lighting didn't change. There must have been ten thousand pounds or more of this glycerine and we had a hard time finding pumps that could handle it, but we finally got some that worked."

Another problem was that glycerine is expensive, so a means had to be found to recirculate it—no mean task when the already goeey substance was full of ceramic beads and broken-up cork or other effects-creating solids. Since the mixture could not be recirculated with all that stuff in it, stagehands stood at the bottom of the set straining out the solids. Meanwhile, others were above pouring or shoveling the stuff back in. "We had people at the top dumping it in and people at the bottom taking it out," explained stage coordinator Edward Hirsh. "The glycerine was slightly red-tinted, and so here were people up to their armpits in this red slime. And because it was being shot high-speed, there was an incredible amount of light being pumped in. So it was in excess of 125 degrees in this confined space. Actually, it was horrible!"

"The glycerine was diluted with water to about the consistency of hand lotion—maybe a little thinner," said Dennis Muren. "The idea was to keep it thick enough so that it didn't ripple—which would have been a definite tip-off—but not so thick that we couldn't manipulate it. Inside the pit tube, at the top of the



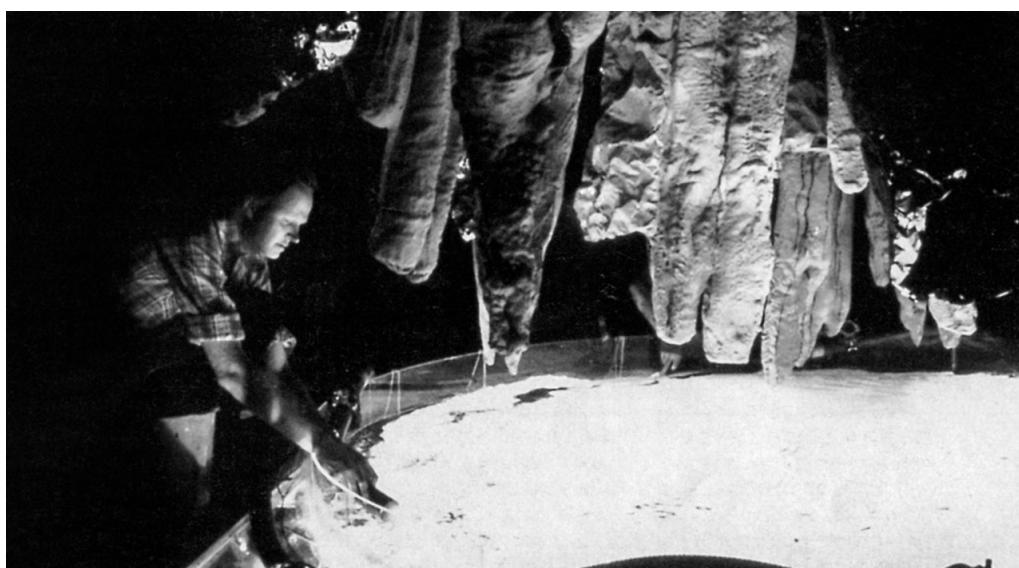
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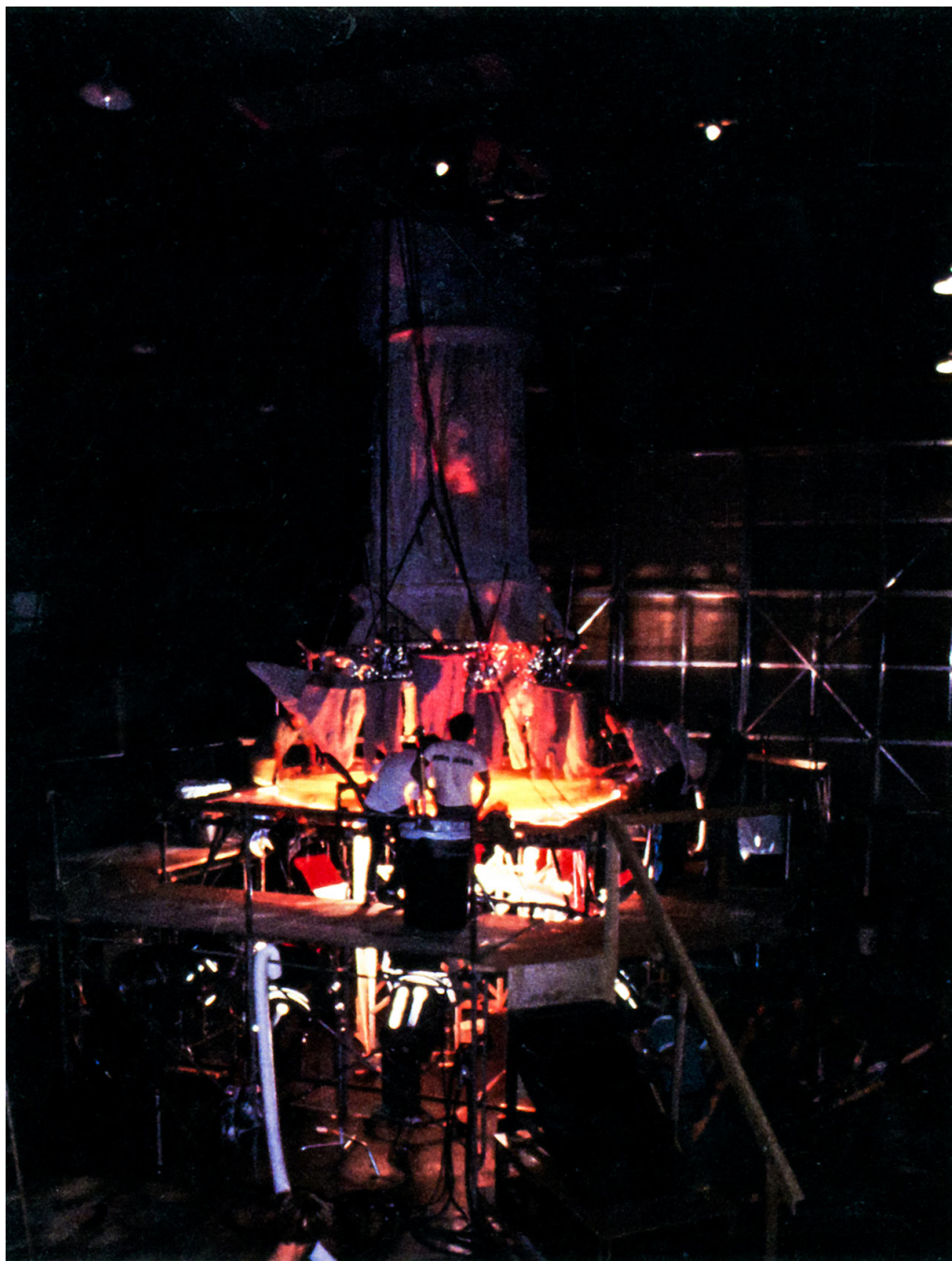
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David Sosalla at work on a











to that spot. We had to have a manifold in the drain to keep the lava at a certain height, and depending on how much the drain was open, we found we could make it burp a little bit in the center. Some were intentional and some were not, but Steven really seemed to like those the best, so most of what's in the film are these burping lava shots." Twenty-six people were involved in the vortex shoot, and with the heavy-duty pumps roaring, communications headsets were required so that Muren—thirty feet in the air and watching the proceedings on a video monitor—could keep in constant contact with his stage crew and with Mike Owens who was directing the action from below. "We did a whole bunch of takes. Since we were shooting it practically live-action, it was no problem—we could do about ten takes on each shot in half an hour. And it was pretty neat. In fact, what was originally going to be four shots in the film ended up being about eight or ten. It was a complex, sticky job, and everybody did a great, great job on it."

As the ceremony reaches its climax, Mola Ram's sacrificial offering—the thirty-inch puppet came to be known as 'Punjab' by the crew—had to be shown actually descending into the swirling inferno. Aware that sustaining the illusion of molten lava was conditional upon not breaking the tenuous surface of glycerine and floating plastic, Muren nonetheless decided to try the most straightforward approach first. "We lowered our actual puppet into the glycerine to see what it would look like and to see how everything would react to it. And it looked exactly as I figured it would. Originally, I thought maybe we could put something over it to cover it up, but the reaction was so phony that there was really no way we could deal with it. So we ended up shooting the cage and the puppet against bluescreen and matting that into a background plate of just the lava alone. Then, at the moment of contact, a lot of steam comes up and everything's obliterated—which is probably what would actually happen. Supposedly, in real life, a person would just blow up if he came into contact with lava like that—all the water in his body would just vaporize."

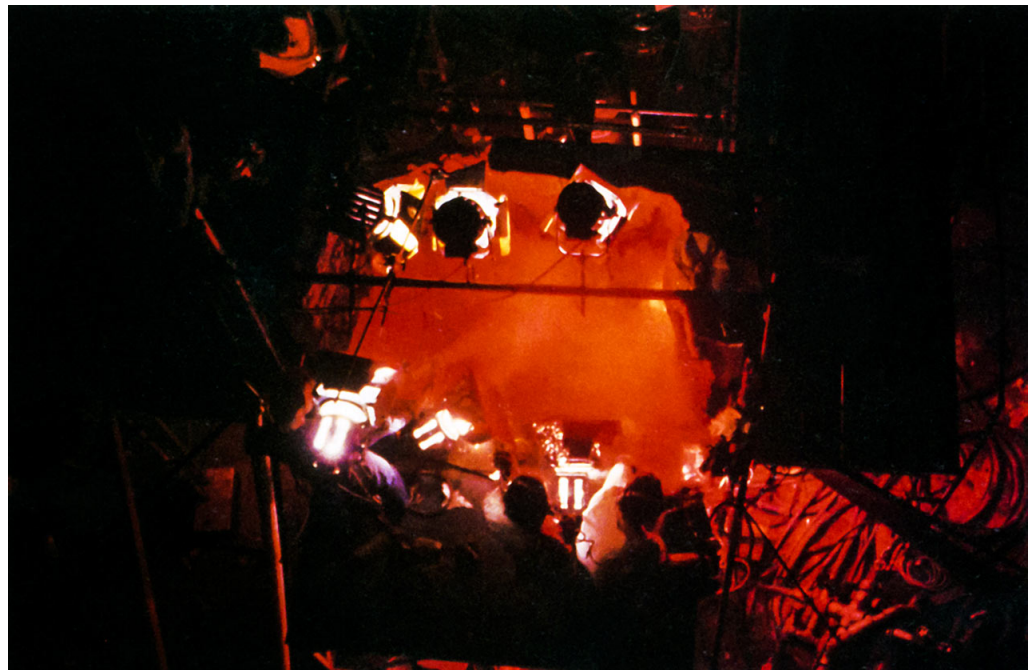
As if this were not a sufficiently gruesome fate, Punjab had already suffered the indignity of having his still-beating heart plucked out by its arteries—a scene which sparked outcries against the excessive violence permissible in PG-rated films and bolstered those factions within the film community pushing for the new PG-13 rating. "You don't actually see the heart being pulled out," explained David Sosalla, who was responsible for the primary insert. "Mola Ram's hand reaches in and you see it turning and then they cut to the high priest's facial expression and then to him holding the heart in his hand. To do the

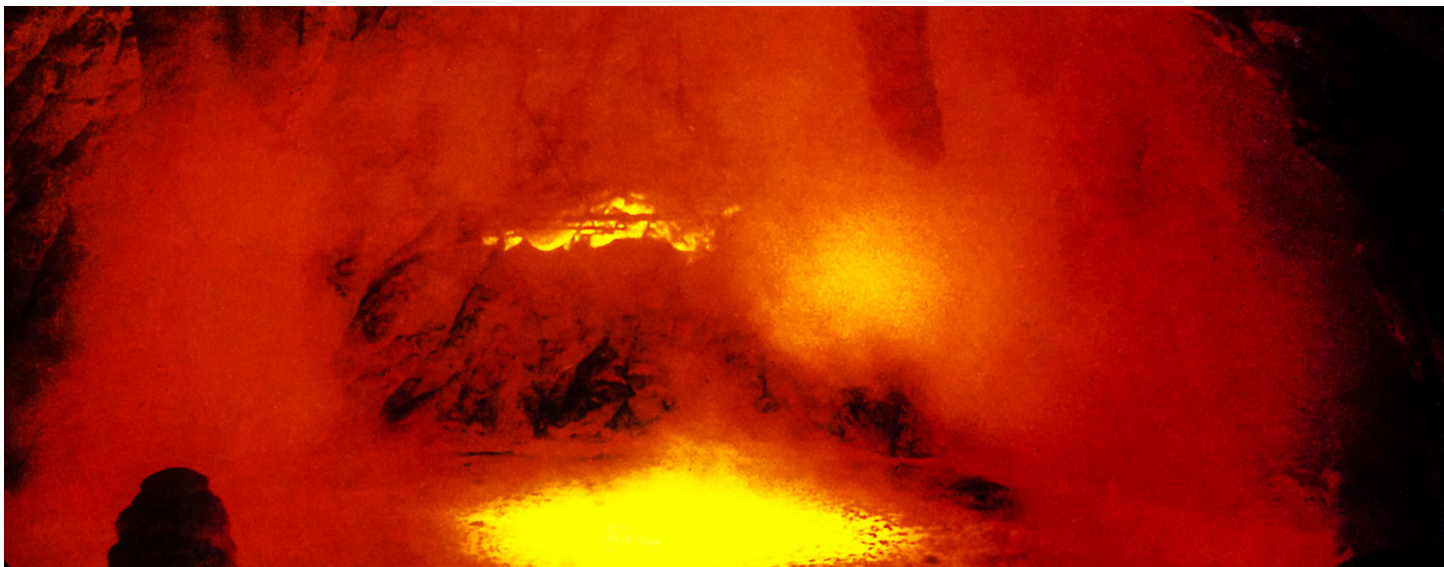
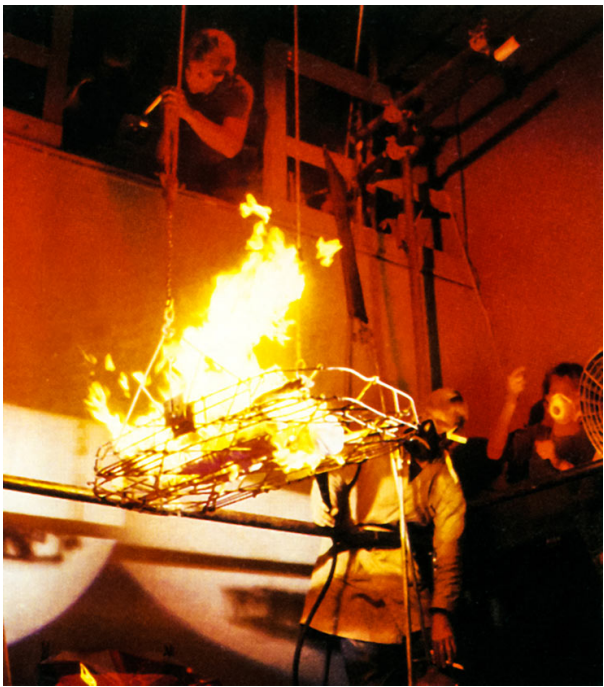
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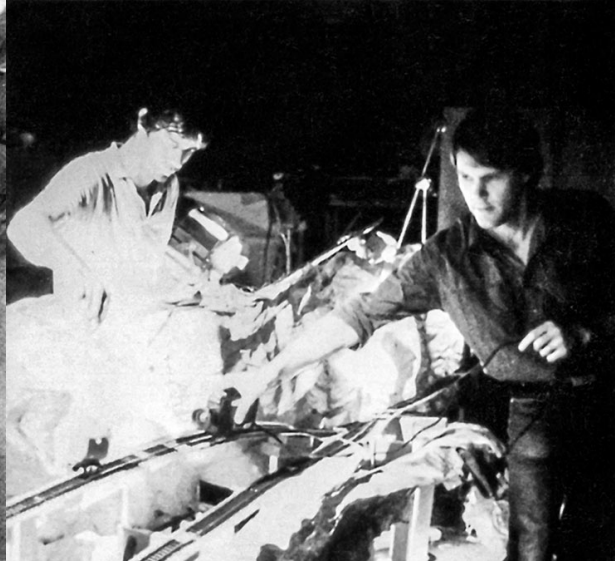
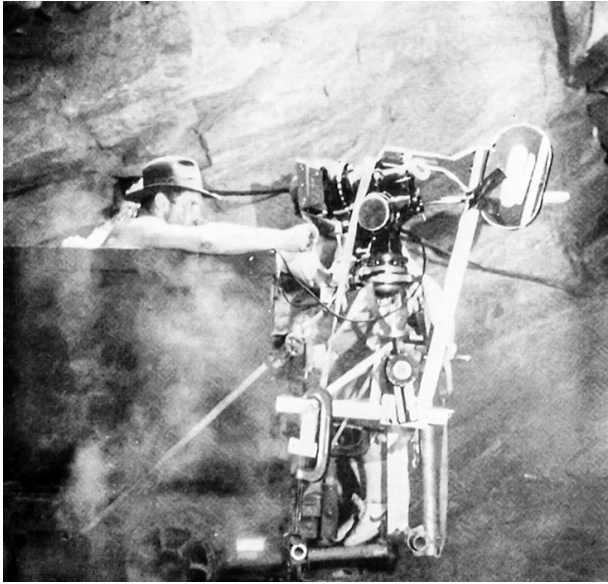
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however, McAlister noted that there was no really consistent motivation for the live-action lighting—a factor which afforded him considerable flexibility in devising his own approach. Nevertheless, he anticipated considerable difficulty. A single scene, for instance, might have three or four areas, each lit with different colored lights of varying sizes. And while it is no great problem using full-size lamps to illuminate full-size objects, it is considerably more complex trying to duplicate those lighting patterns using full-size lamps on corresponding miniatures because of the difficulty in isolating small portions of the model. Compounding the problem was the physical size of the sets, which precluded any possibility of actually getting lamps inside. McAlister's ultimate solution came by means of the tiny practical light bulbs strung throughout. Though totally inadequate for any kind of real exposure, they did serve as motivating forces for some strategically placed outside lighting. To this end, McAlister would locate each hanging light bulb, cut a concealed hole in the foil or paper rooftop and shine in a powerful stage light from the outside. In this way, lighting patterns could be created that had some semblance of appropriateness.

Constructing and lighting the miniature sets was, of course, only part of the problem. There still remained the question of how the mine cars—built by Charlie Bailey—would be made to travel over the twisting tracks and how the inanimate human puppets inside could be brought to life. Just keeping the cars from derailing was a considerable problem in itself, especially since at first it proved difficult bending the straight-line track sections into curves that were still parallel. Ultimately, model-maker Pete Ronzani devised a small mechanical bending device he could crank the track through to get desired contours and configurations. As for motive power, some sort of motion-control system would have been ideal, but Muren and McAlister soon realized that with all the hills and valleys in the track design—some of which were quite steep—any sort of motorized car would simply slip right down the slopes. For a while, they considered a straight stop-motion approach, using small set screws to lock the car onto the track during each exposure. "Finally, we came up with the idea of using little stainless steel cables to pull the cars along," said McAlister. "We tried different ways of driving the cables and ended up using a winch arrangement—like a winch on a sailboat, where you wrap the rope around the winch and that gives you a lot of pulling power. As a takeup for the cable, we used a motorized fishing reel and put it on a constant slip—adjusting the clutch so there was always a little back pressure on the cable to keep the line taut. The winch actually

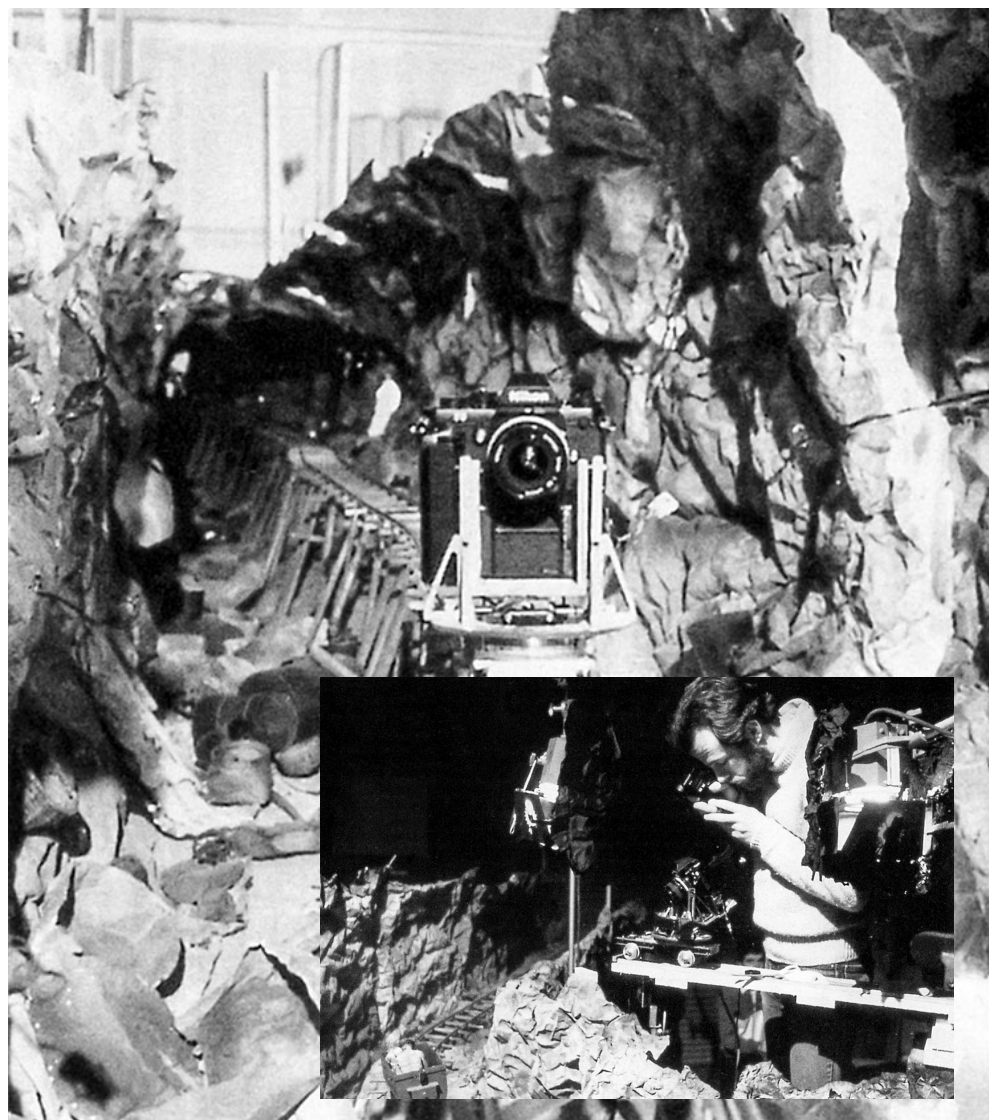
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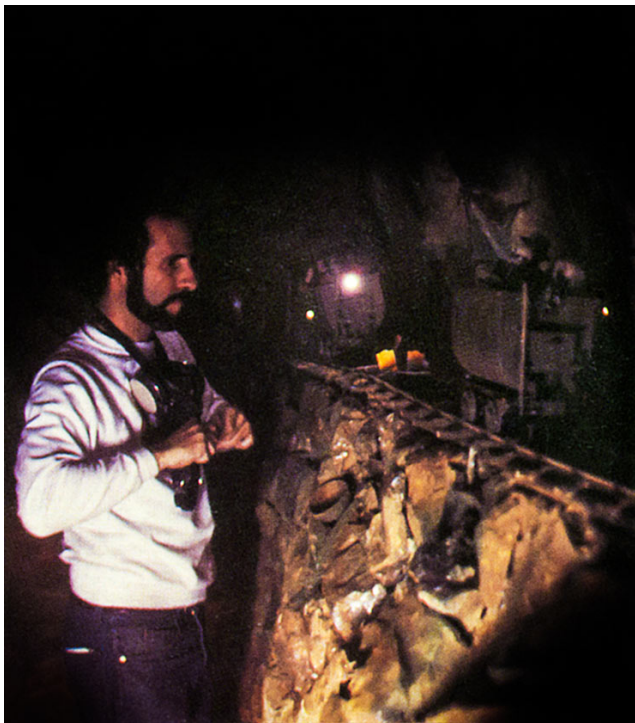
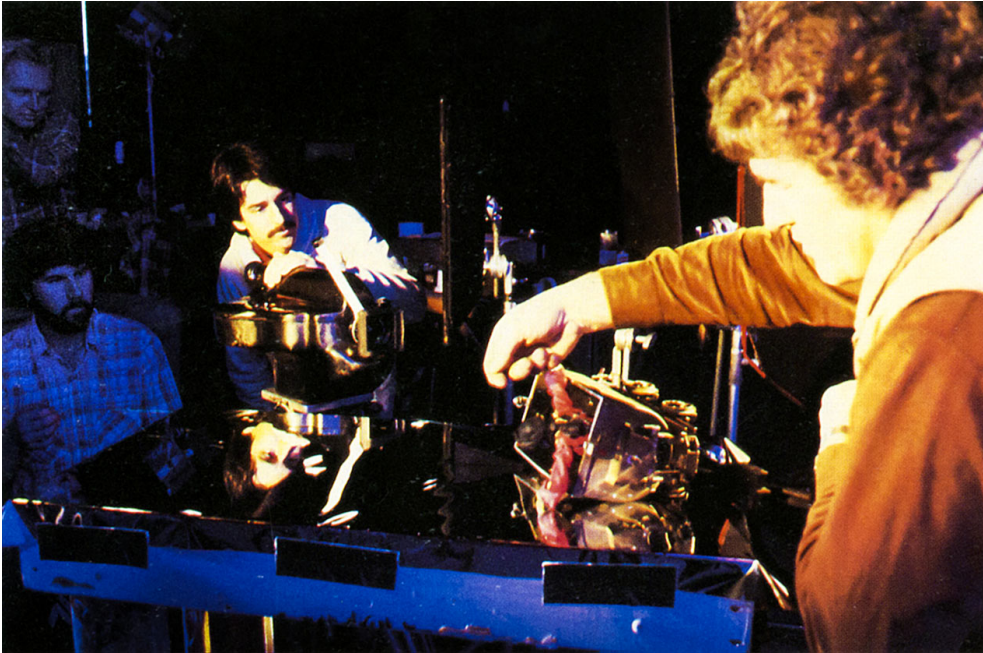


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"After a week or two of shooting and animating," recalled McAlister, "we began to realize that sometimes we were getting the choreography of the animation too complex. Dennis Muren was good enough to help us out and show us that in Steven Spielberg's cutting it's usually one idea for one shot, and he just strings all these ideas together until he's got a story. After that, we'd just determine what that one idea was—a bad guy taking a shot, Indy ducking, Willie falling out of the car, whatever—and then design the shot in such a way that the action would take place at the right part of the shot so it would read the best. If that meant waiting for a certain pool of light before making a major move, then that's what we'd do."

St. Amand also applied a lesson he'd learned years before from one of the grand masters of cartoon animation. "When I was at Cascade, Tex Avery once told me: 'You don't want to make a major move in the first eight or nine frames of a shot because the audience needs that much time for their eyes to get used to what they're seeing.' I'd always known that, but now it was being driven home a little more. I had a chance to try some very bold moves on this show; and in a way, I was forced to because in most of the shots, the cars are moving so fast that unless you do a really bold move, it just doesn't read on film. *Indy* was a very creative thing for me—more fun than doing a walking machine, for instance. I did about half of the walker shots in *Jedi*; and that was fun, too. We really tried to give them a personality. But if you're working on a person, you've got the personality already. At one point [assistant cameraman] Joe Fulmer said to me: 'Tom, you'll never be Harrison Ford; but for a few scenes, you'll be Indiana Jones.' And I guess that's true. He's very physical—always moving his shoulders and head back and forth—and I tried to capture the

During stage III and I thin wire the mine covered used in blue screen matte. I provided surface surround. Later, it would be background one of the sets. I, Pat Swiney, mine cart. Shorty is tug-of-war over a r bottom-with bit Modelm. prepare: subsequ which li splashes



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During the stage test, the thin wire used in

have been both difficult and dangerous. It was relegated to the ILM miniatures to be a relative term when it came to

Outside, in the ILM parking lot, under the supervision of Patrick Fitzsimmons, work for the quarter-scale replica—a set by thirty feet long and eighteen feet high—was a 1300-gallon water tank—six feet wide and about six feet in depth—rigged to be pulled to tip it over and flood the canyon. It was devised by modelmaker Paul H. The tank was first open up and then fall forward, in a single pivot point. Since the tank was 11,000 pounds of water against the miniature, it obviously could not move or buckle when it fell. The basic aluminum foil structures had to be covered with a type of roofing urethane and a foam and lumber superstructure. The heavy-duty urethane foam spread over the set of moist sand. More importantly, the tank was poured into the asphalt and poured concrete to build a building. In fact, as the tank fell, the passers-by were heard to comment that it was decided to build condominiums on the site. The set was fully framed—primarily by stagehands and Lance Brackett—Lorne Paterson stepped in to recreate the full-size set in miniature. The complete set included a giant ore-smasher, plus an abundance of breakaway scaffolding and other structures.

Toppling the tank was no problem, but stopping it proved to be quite another matter. In fact, the 11,000-pound figure they'd been using proved altogether misleading. "To stop the tank from destroying the whole set when it fell," said Fitzsimmons, "we connected it to a 45,000-pound rated cable. For our first try, we had the tank about half-full, and no water in the lake where it was to land. We figured the cable would easily hold it. Well, the cable snapped. So we went to some of the engineering wizards in our east bay and asked them to calculate the actual force for us—and they came up with the astronomical figure of something like *six trillion* foot-pounds of force."

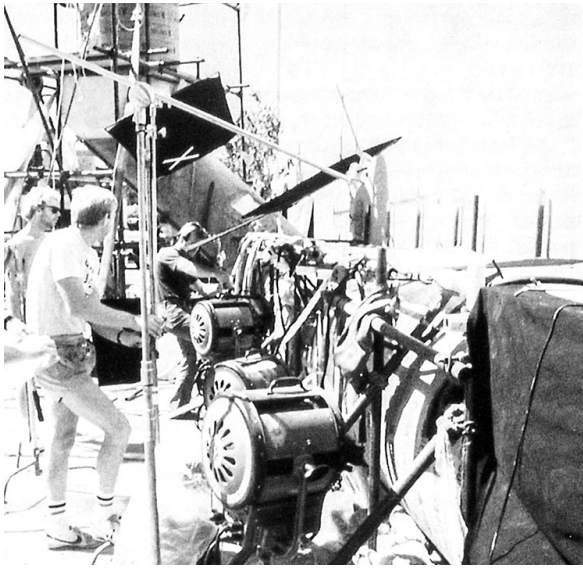
With new-found respect for water, the stage crew took several immediate steps to delineate and diffuse the force. "We decided we had to take a different approach and make it act a little slower and also to actually use the lake that it fell into to absorb



have been both difficult and dangerous. The task, therefore, was relegated to the ILM miniatures team, which was a relative term when it came to the task at hand.

Outside, in the ILM parking lot, under the supervision of Patrick Fitzsimmons, the team worked on the quarter-scale replica—a structure that was by thirty feet long and eighteen feet wide. The set was a 1300-gallon water tank—supported by a rig—pulled to tip it over and flood the cave. The tank was first opened up and then fall forward, in a single pivot point. Since the tank was supported by thousands of pounds of water against the miniature structure, it could not move or buckle when the tank fell. The basic aluminum foil structures had to be supported with a type of roofing urethane and a foam and lumber superstructure. The heavy-duty urethane foam spread over the structure and of moist sand. More importantly, the structure was poured into the asphalt and poured concrete to construct a building. In fact, as the tank fell, the passers-by were heard to comment







on the first pass. And they fully expected to have to shoot it more than once. As it turned out, they were wrong on both counts. With high-speed cameras whirring, the tank toppled into the reservoir, sending more than five tons of water rushing through the miniature set. Surprisingly, the tank remained intact and could have been rerigged and used again, but there was no need—the perfectly executed shot had been captured on the first take. All that remained to be done was the bluescreen compositing of a few fleeing figures, just to add a little life to the shot.

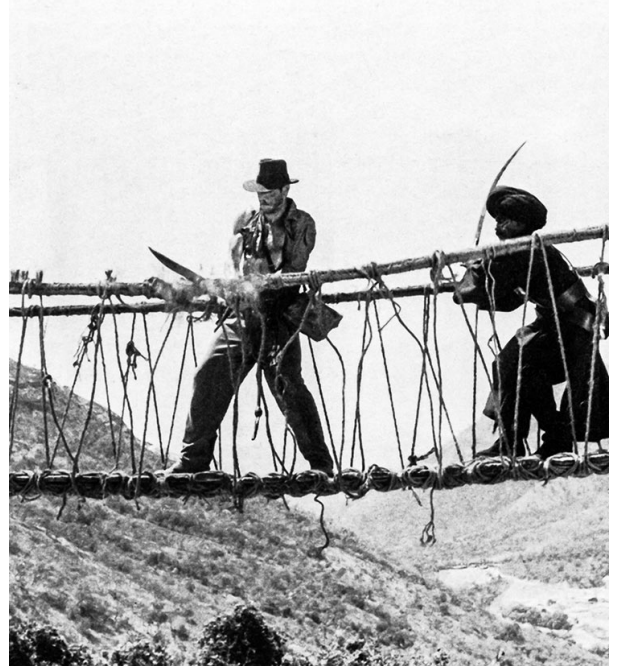
The collapse of the water tank initiates a whole sequence of water-in-the-tunnel shots requiring a second large-scale parking lot setup. The principal tunnel structure for these scenes was pieced together from sections of four-foot diameter sonotube—heavily reinforced and wedged up against the outside wall of the studio, which acted like a brace. “Even though they’re basically just glued cardboard, those sonotubes are incredibly strong,” said Lorne Peterson. “In fact, they’re primarily used for casting concrete. We had to seal them really well, though, because the glue is water soluble. We’d take the sections, drill holes around the edges and sew them together with nylon rope. Then we’d use urethane foam to foam all the joints—so we had the combined strength of both the foam and the nylon.” Once the basic twenty-four-foot structure was completed—primarily by stagehands Bob Finley, Dave Childers and Harold Cole—it was elevated on one end and connected via a chute to a large dump tank with a simple trap-door mechanism that could release more than 5000 pounds of water on cue. Then the project was turned over to Lorne Peterson’s modelshop crew. “Inside the tubes, we built our tunnel structures from urethane foam and real rocks. In fact, we spent a lot of time finding rocks that looked good at that scale. The problem was that as we built up the tunnels, the four-foot diameter got narrower and narrower, to the point where only Randy Ottenberg and Marc Thorpe—two of our smaller model builders—could get in there to work. They had knee pads and elbow pads and wore slick polyethylene-coated suits so they could kind of slide through the caves. In addition to building the basic wall and rock structures, we cast up a bunch of old beat-up fifty-gallon drums that varied in scale from four-and-a-half inches to seven inches high. When the water came through, some of those barrels would get swept up and hit a rock or something and go tumbling right by the camera lens—it looked really good. We also had lanterns and baskets and strings of electric lights. We even joked with Frank Marshall about dressing cockroaches up in little mouse costumes, just to add that extra touch of realism.” Between scenes, the dump tank was replenished—a task requiring about twenty minutes and accomplished by means of firehoses tapped into main water lines.

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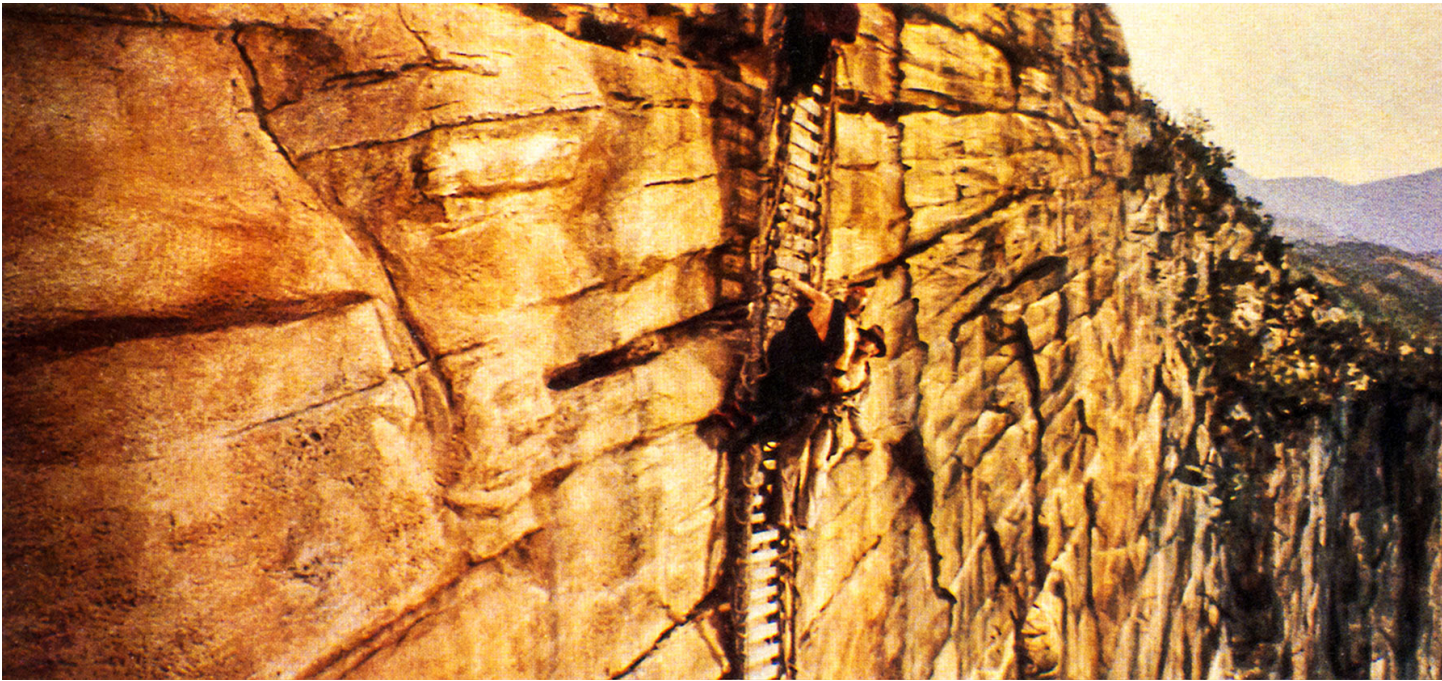


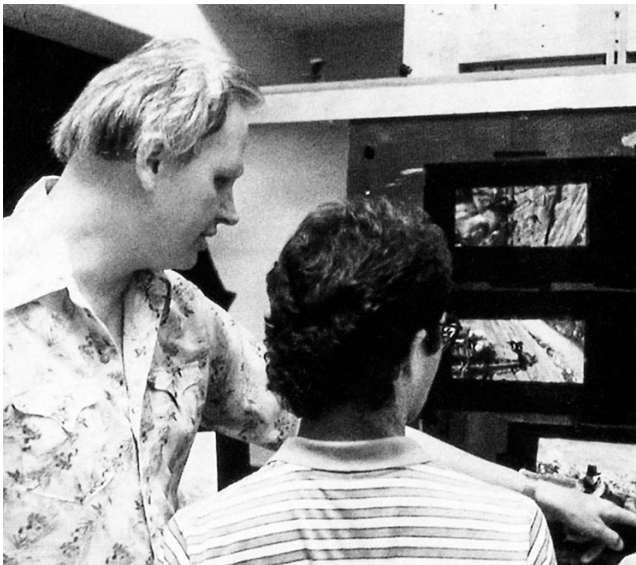






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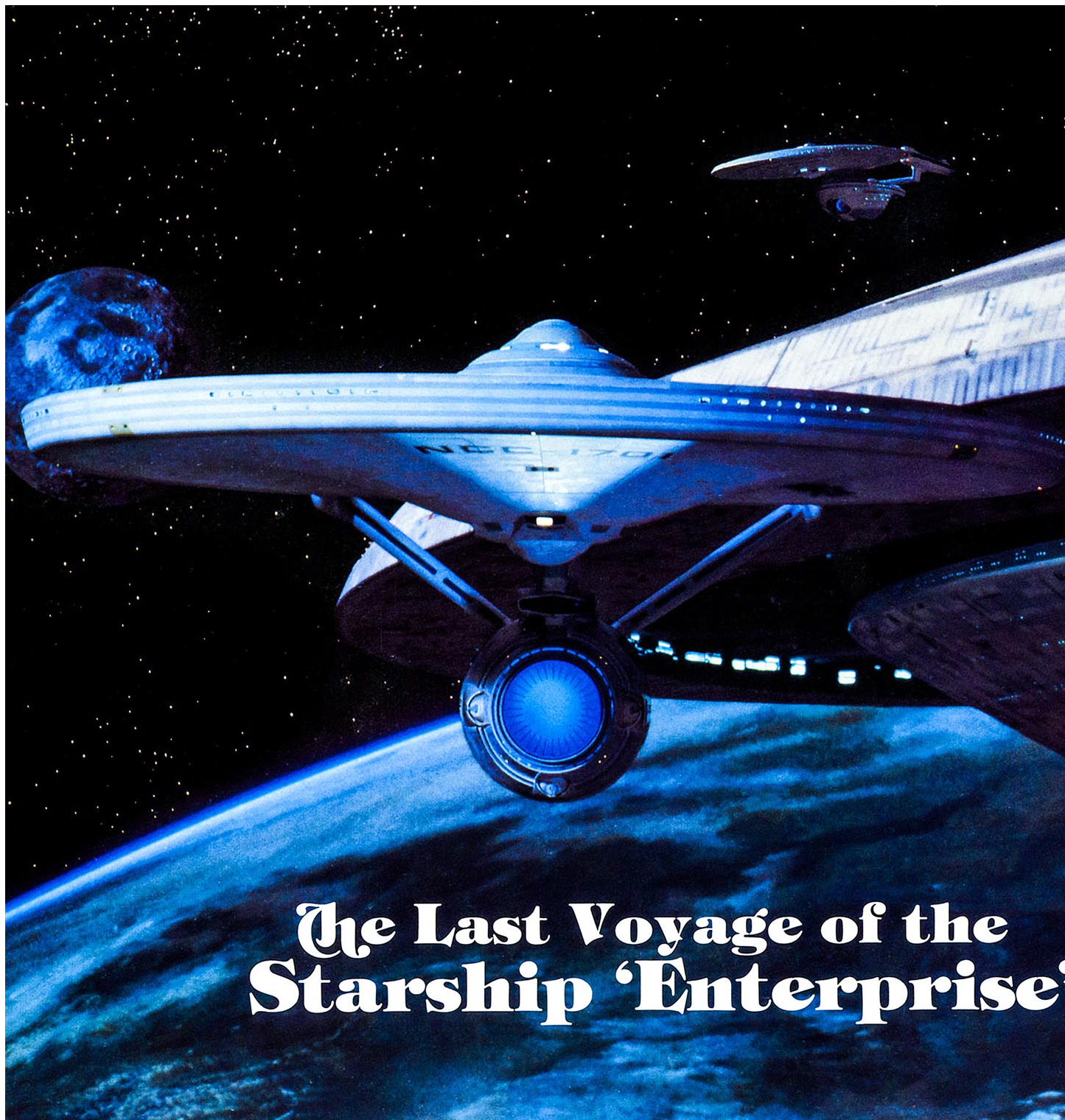
the live stuntman fell out of our plate area we could pop to a stop-motion puppet and continue the fall on down. We did actually try that in another part of the film, just as an experiment, but I finally decided that I didn't want to try it on this stuff because it was right at the end of the film, it was bright daylight and we wanted everything to be as real as it could possibly be. So we ended up using those cuts *after* the people have fallen off, putting in stop-motion figures the whole time. We did about twelve of those shots from a number of different camera angles, and the figures are all pretty much falling at the start of each cut."

Howard Stein found the effects editorial end of such sequences especially challenging. "For me and Mike Gleason, it was unusual editorial work. We did a lot of weeding things out and figuring out what was going to work, especially in context with the stuff around it. In our space movies, for example, every shot has to work with the shots around it—continuity, speed, composition—but it's somewhat simpler because we're working in total sequences where we have a certain amount of freedom. On *Indiana Jones*, we didn't have any sequences that were built just from ILM shots. Everything had to cut in with the live-action—even in the mine chase sequence where we did an awful lot of shots. That makes things a great deal more critical for us."

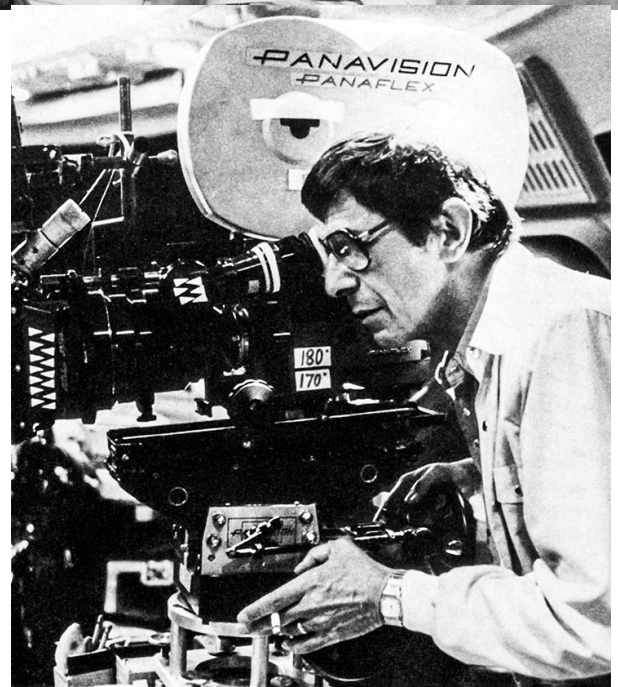
Though the final effects work in *Indiana Jones and the Temple of Doom* stems from the cumulative expertise of a hundred or more skilled artisans, the vision and direction—as always—came from George Lucas and Steven Spielberg. "We felt very fortunate working with Steven," said Warren Franklin. "Both he and George know effects as well as anyone, and they have the vision to see what things will look like on film. Steven was actively involved—approving shots and making suggestions—but he was down in L.A. most of the time, and so it was up to Dennis Muren to make the day-to-day decisions and keep the work moving along. Fortunately, Dennis is extremely talented and—particularly after *E.T.*—he and Steven have a very good relationship and very similar ideas. If Dennis came up with something that was different from the approved storyboards, he was not afraid to try it—even without Steven's prior approval. Generally it looked great and Steven was totally happy with it. They thought enough alike to be able to do that and they were open to each other's ideas, and it made for a very happy working relationship. It would have been very difficult if the director and effects supervisor hadn't had that kind of rapport."

Robert P. Everett is an occasional freelance writer with extensive editorial and publications background, including a stint with National Geographic. A colonel in the U.S. Air Force, Everett has—at various times in his career—been editor of *Airman*

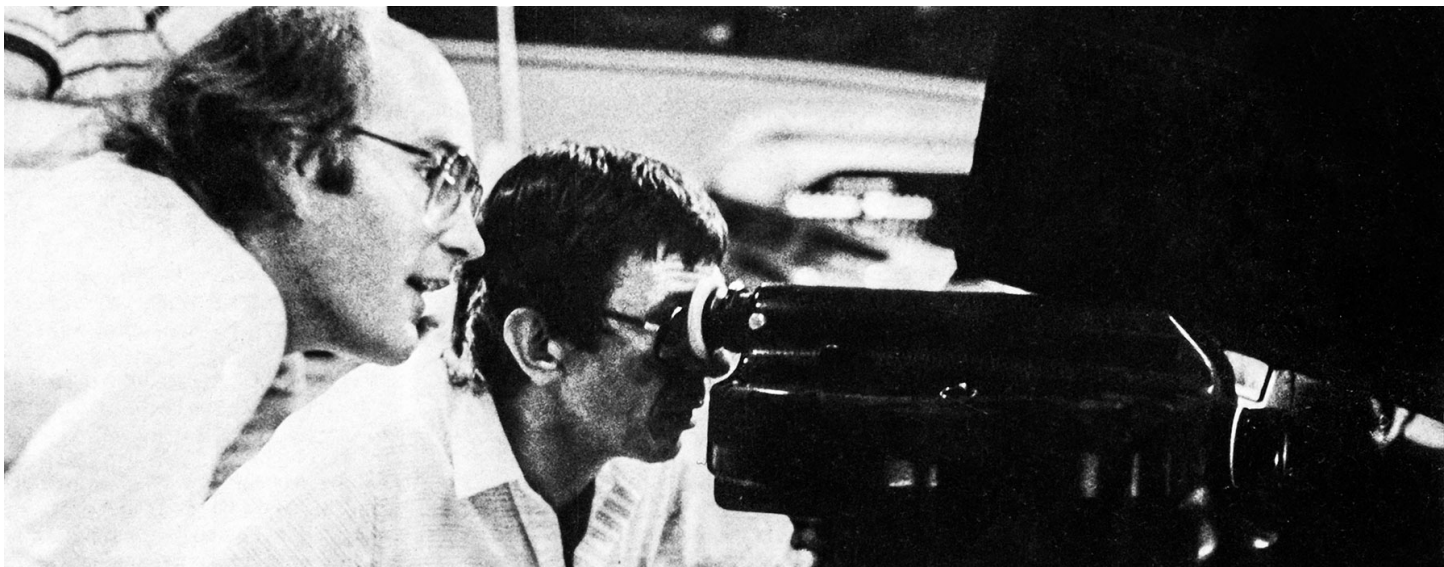
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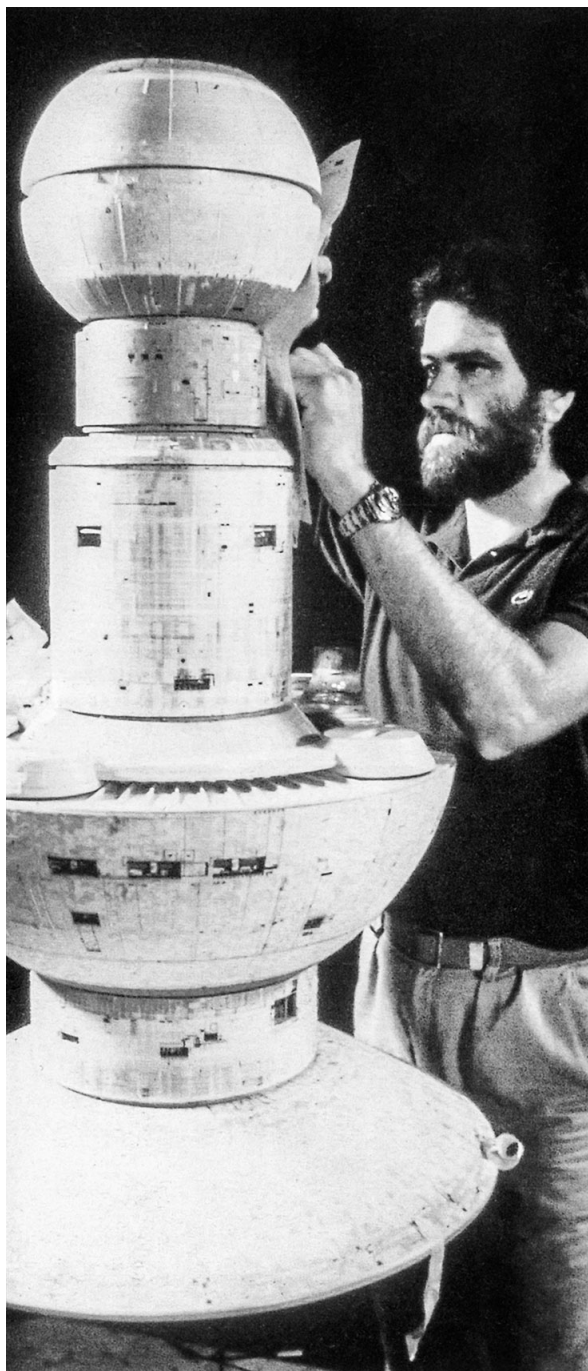


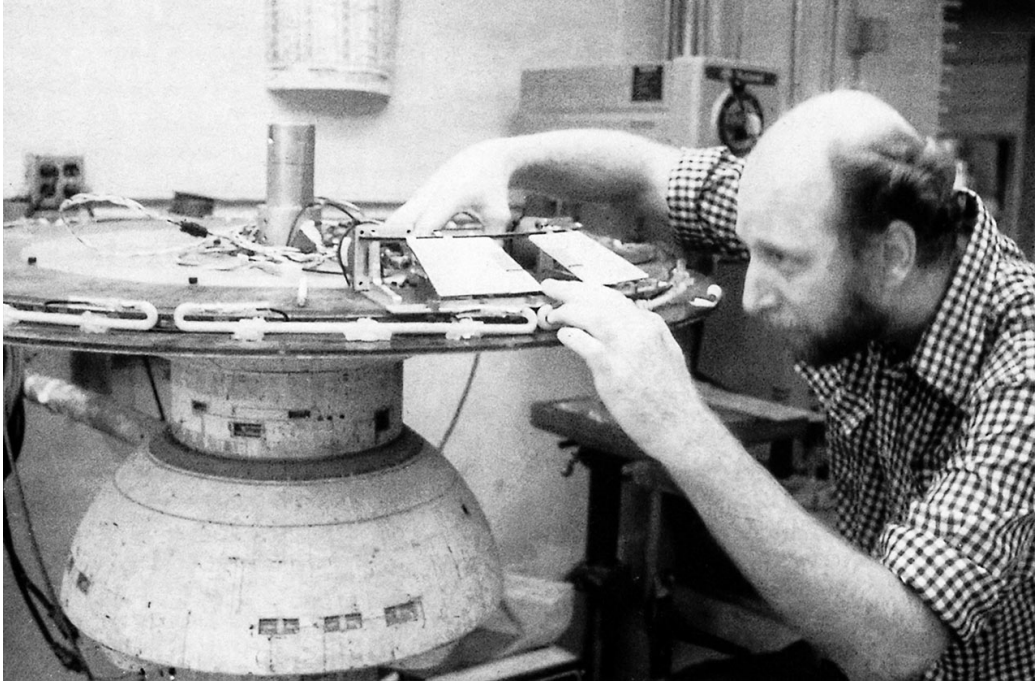
The Last Voyage of the Starship 'Enterprise'

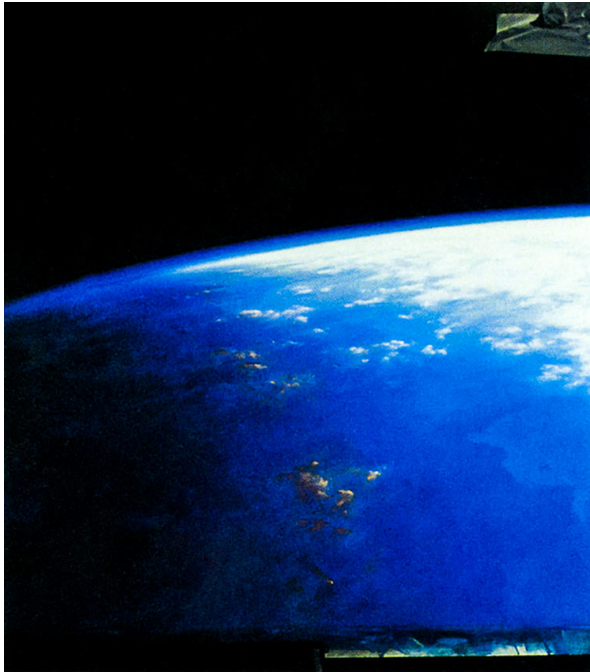


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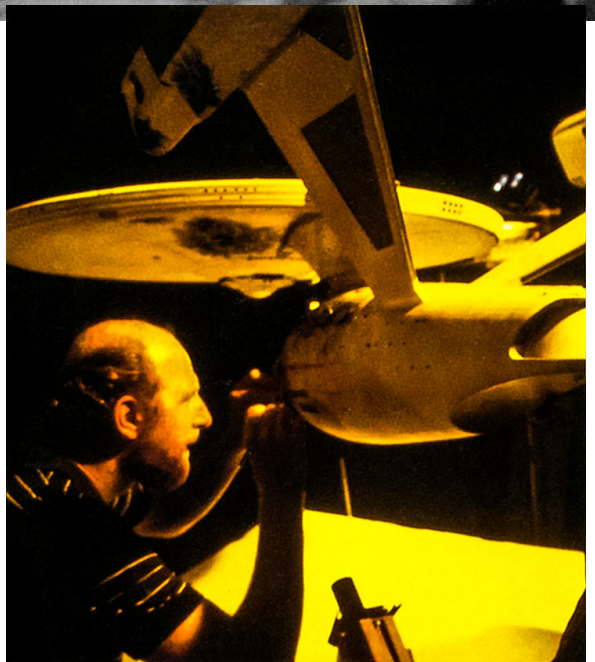
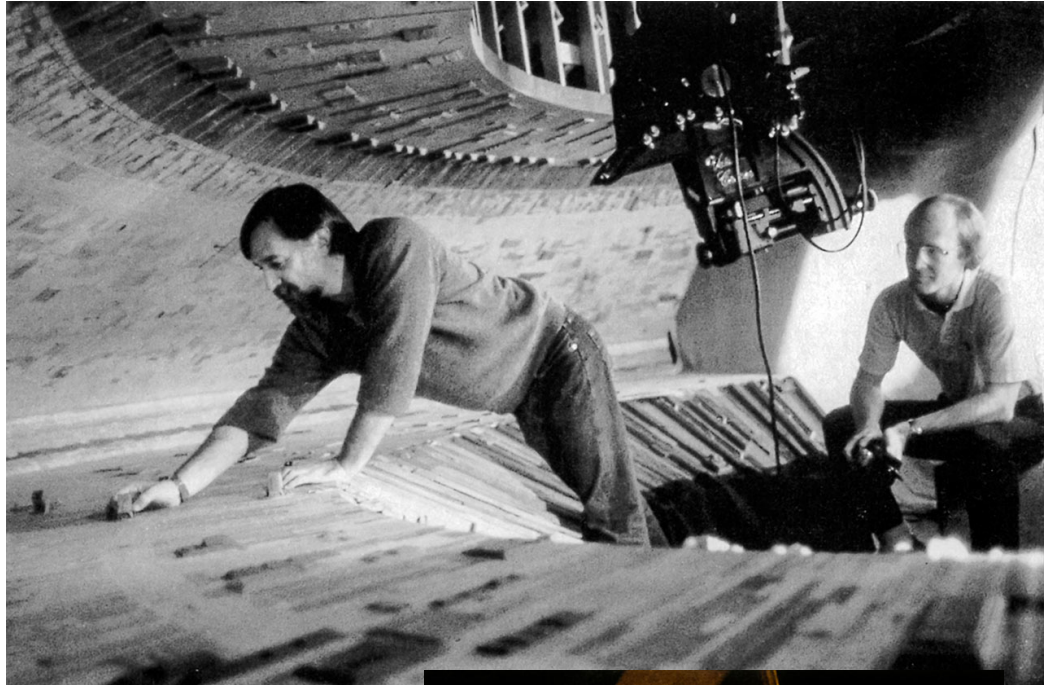
reflected on the white card or screen, using the same motion control program we've already used to photograph the model." The result is an explosion that actually moves as the exploding object does, traveling as it travels. For this separate film pass, the model itself is usually draped in black velvet and functions as a matte, blocking out any areas of the explosion that would normally be blocked by the ship's move. "There were about seventeen shots just of the motion control elements," Dow said of the initial skirmish. "Then there's stuff that we shot down on the stage at Paramount. The interior shots are intermingled with the effects."

Having neatly dispatched the merchant ship with photon torpedoes, the *Bird of Prey*, with its exotic shape and equally showy decloaking, goes on to play a prominent role in the film—particularly later, when it becomes the *Enterprise* crew's only means of transportation. The ship itself was designed by art directors Nilo Rodis and Dave Carson. "It's a beautiful ship," Dow commented—and Ken Ralston agreed. "It has some of the basic bird-shape, but it's more ominous. Actually, I think they wanted a sort of football player look—that guy's on the line, and he's gonna tear your head off. On the underside, there is a bird design, but it's pretty difficult to see because it's so integrated into the body. It's more graphic—straight-line and military-looking. Klingons aren't into aesthetics, you know."

One other major effect is introduced in the opening sequence—a new creature, created by Ken Ralston and crew, that dies an ignominious death on the bridge of the Klingon vessel. The idea came about as a result of Ken Ralston, early in the project, doing something he doesn't always do. "I read the script—just for the hell of it. And I thought, 'Wouldn't it be neat if the main Klingon crew had this mascot or pet of some sort?' So I sculpted up this monster-dog-thing—a very mean-looking reptilian dog. They went for it, and wound up working it into the script." The reptile-dog—usually nameless, though occasionally called 'Fifi Rebozo' by the more perverse among the crew—was basically a hand puppet with cable work in the face, ears and jaw. Ralston operated the head and the body from beneath a specially constructed command chair in which Kruge—the only Klingon who could touch the best, apparently—would sit.

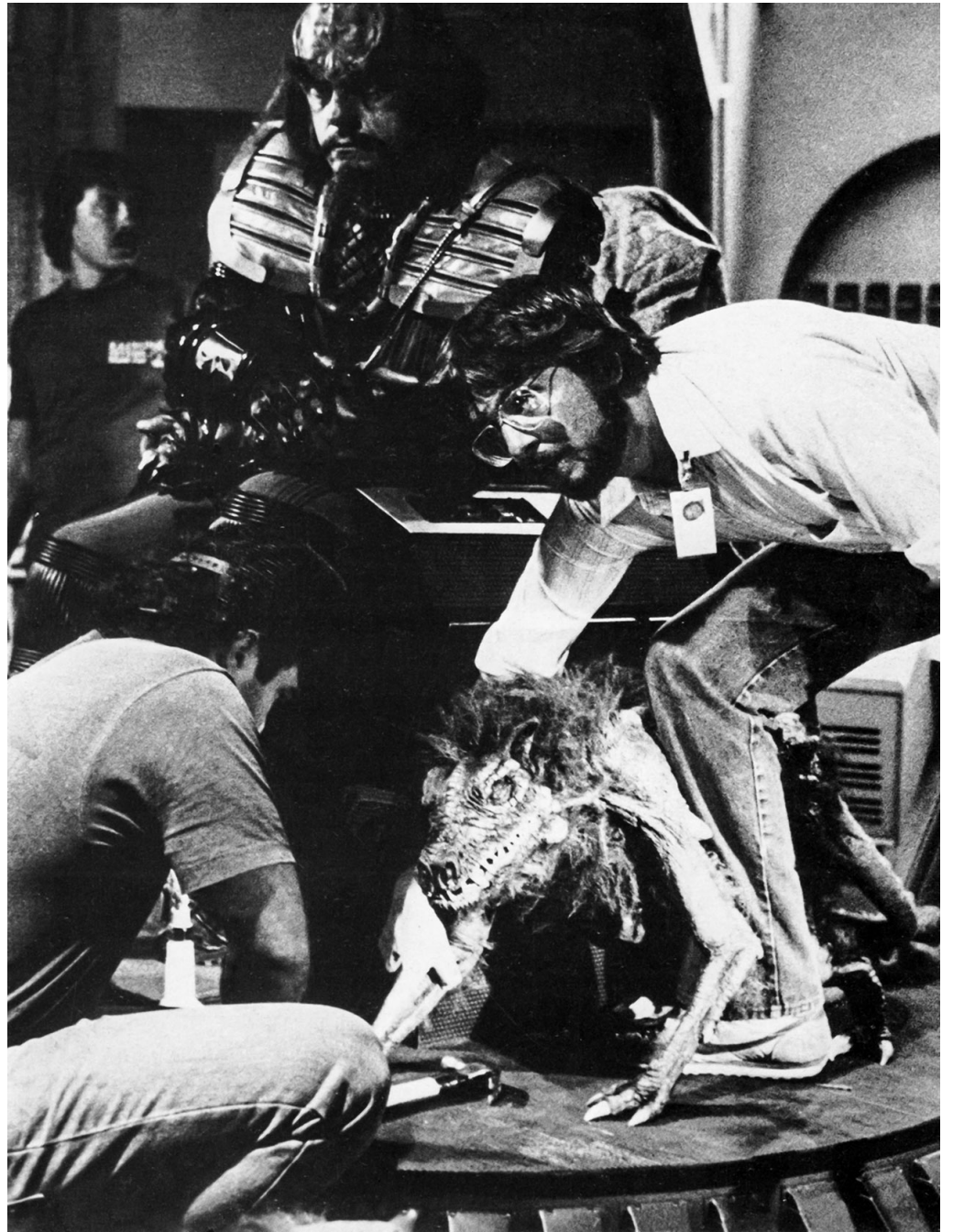
David Sosalla, *Star Trek*'s creature supervisor, worked with Kirk Thatcher and John Reed to bring this "gnarly, scraggly, kind of hound-lizard, I guess" to life. Though Sosalla had had few previous opportunities to build and operate puppets such as this, he had recently gained considerable experience working with Chris Walas on *Gremlins*. "The skull of the dog had all these little floppy hatches and slides that moved up and down," Sosalla explained. "The outer Schram skin was carefully glued down over the top of that, and tacked just in certain areas so the slide would get the full movement and the Schram would

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Ellen Lichwardt, another of ILM's rot to solve an equally difficult problem th final fight scene between Captain Kirk a Kruge. "Kirk and Kruge are fighting on Mullen recalled. "It was shot down at P: velvet, rather than against bluescreen the principal photography was complet put in a background of glittering red l It could have been a bluescreen shot, have been pulled optically, but it would difficult to shoot with the blue screen d raphy. So animation was called in. The p hair and body were against this lava. articulate work. Otherwise, you'd get a behind him. In the final version, it doesn in there at all."

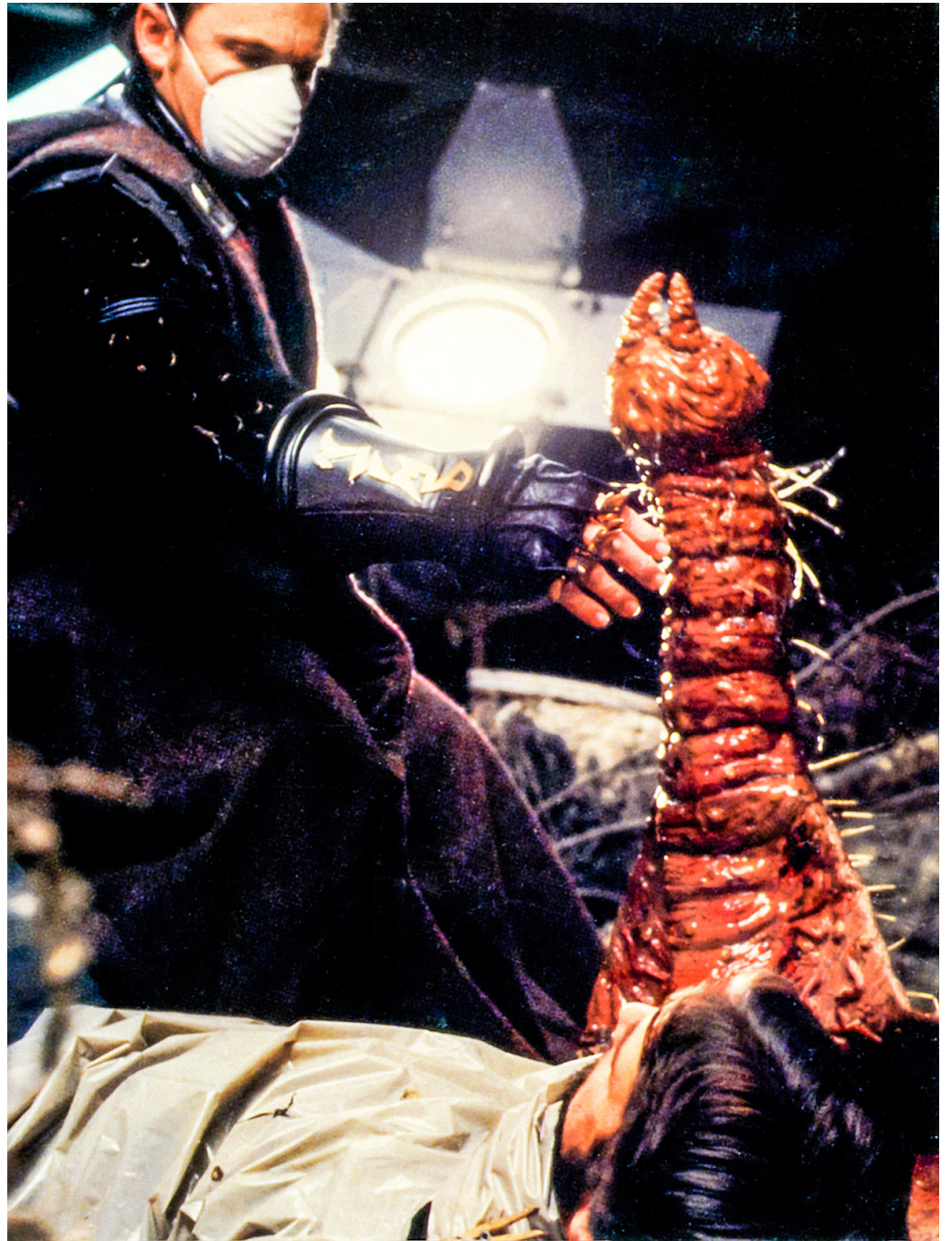
As the plot unfolded at the space do taking place in secret, on and above th among them is the destruction of the the *Bird of Prey*, leaving Kirk's son D: Vulcan woman Saavik stranded on the that destroys the *Grissom* is not terribly admitted as much. "It's real quick. Th they look, they see—and boom! It's ov be. I didn't think we should do someth point. If we played all our best cards nothing left to show when it came tim prise. We tried to shoot some pyrotechnik but I wasn't happy with what I was getti cleaner and more sanitized, so it's just a of explosion. I think we ended up explosions."

The use of stock elements at ILM is particularly as their library of effects g approached as 'Gee, we could save some and got this shot from the library,'" s far as I know, there's no such thing as a but yes, we *do* use stock elements. Ofi ment that was originally for another sce very tricky for an effects editor—getting from Scene 26 could be used in Scene 10 perhaps seventy percent of the explosi culled from their stock library, but al to be specially choreographed to acc model or sequence.

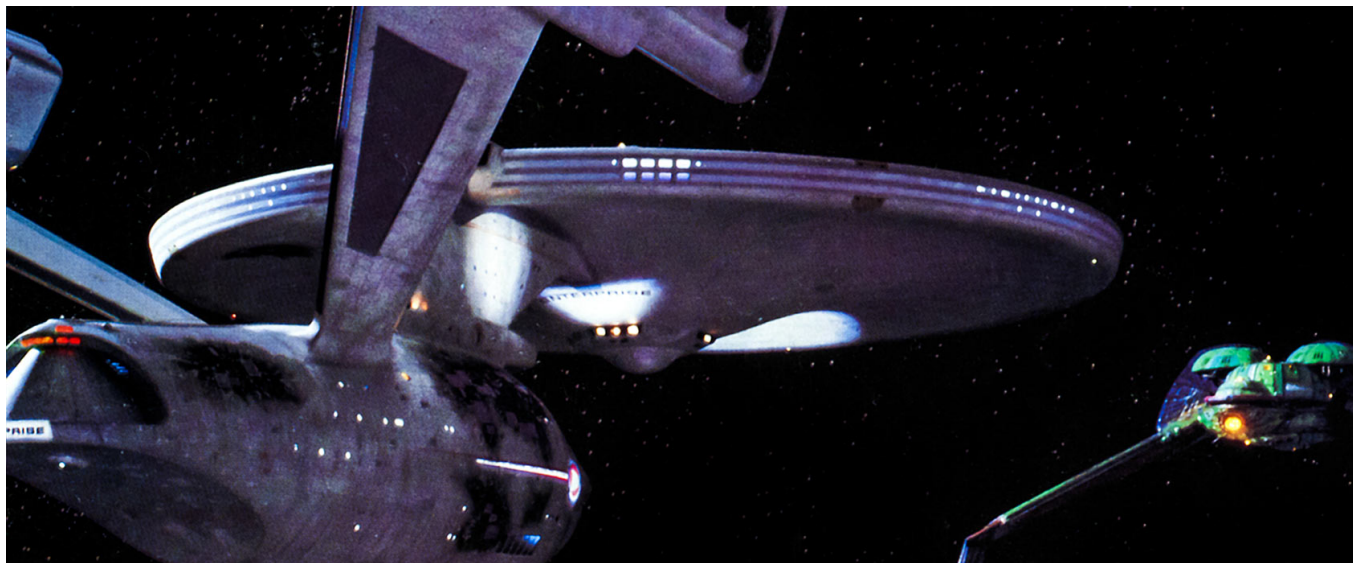


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wouldn't take the top of their heads off if somebody's transporter lit up behind them." Finally, the Federation and Klingon transporter effects had to look different from each other. "The Klingon transporters are red and yellow—they look more aggressive, more flickering than the Federation ones. The Federation's transporters are a lot smoother, while the Klingon transporters are more erratic. It's just a subtle thing, but it works real well."

All in all, most of the people involved agreed that the transporter effects were more trouble than was really necessary. "I'm sure they had a formula for it on the television show," said Mullen. "But sometimes we get ambitious for a certain look, and you start discovering the implications of that. It means a considerable amount of work."

Nevertheless, just as much attention was paid to another 'old' effect—the rainbow-colored hyperspace trail that is the *Enterprise's* warp drive signature. "Most of the warp drive shots in *Star Trek II* were taken from the first movie," Don Dow noted. "They just used stock footage." But this time, they wanted something new—or at least improved. Still, the streak effect was tried first. "You do a beauty shot of the ship, then go back and do streak passes for each intensity of light. The bright running lights and strobe lights would be together because they were the same intensity, but the interior lights would have to be shot differently because they weren't as bright. Then the radar-dome blue in the center would have a pass of its own." But problems developed. For one thing, the *Enterprise* changed perspective in these shots—it actually grew larger and slightly distorted, and the streaks seemed noticeably out of place. "Also, our track apparently developed a little bump. Over a period of time, I guess the ground settled or whatever, so when we were doing a streak shot, every bump and ripple showed up."

A straight animation warp drive was attempted as well, but Charlie Mullen felt it looked much too animated. "It had been done as airbrushed artwork that was cross-dissolved, and it looked real bouncy. This was early in the film, and we didn't really like it, but they cut it into their workprint down there and told us to keep working on it. We came up with something that was quite a bit cleaner and nicer; but by that time, they had gotten used to the original version and wanted us to lean back in that direction again." The crew ended up going through five or six different approaches to the warp drive, and it was not until a few weeks before release that a final 'look' was approved.

After experimentation with several other approaches, ILM's effects animators came up with a technique that created a

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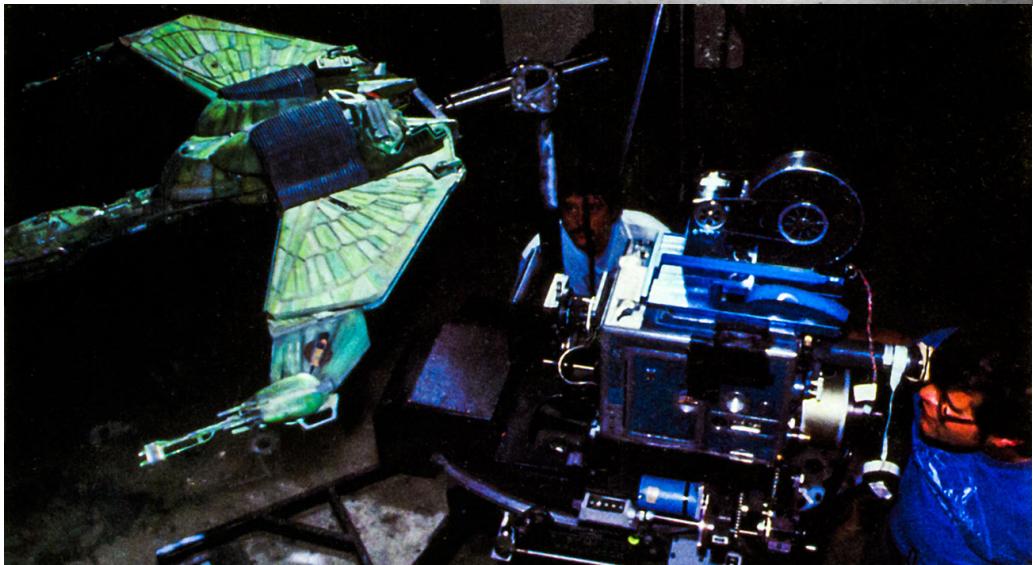
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miniature pyro. You can't tell a thing you can do is shoot at high-speed and

The final burn took place with the help much earlier by Thaine Morris during the computerized clock-timer that could actually within hundredths of a second to accomplish photography that was essential to the honest," Moehnke admitted. "I'd never But we were lucky enough to have Mike done it, so we developed a controlled burn that Mike and Lance and John built that We had fifteen or twenty guys working was pulling the ropes. Lance and Mike Another guy got hold of all the vermicrumbling earth and rock. Ignition was we could take a torch and ignite prop a fire retardant for putting flames out working with material that couldn't be was happening, the computer's solenoid coming down, and the pyrotechnics would leap up through the crevices through their stuff down. You had flames in the going off in front, and the flames were feet in the air. We shot it from all different 10K light with a gel on it, and we put smoked up the entire stage. Even in 16mm It actually looked like the entire world

But even as the Genesis planet was shown the *Enterprise* was under attack. Its final result of a massive conspiracy between specialists, animators, visual effects artists—all under the direction of Ken R blows up in a series of shots. The bridge starts to keel over and—this is the shot you see the famous NCC-1701 sapping a Then the saucer comes up towards camera blows up in one big, fiery mass. Then the *Enterprise* falling out, with most of only the gridwork left. Then it falls in a few long shots of this comet going down face as Kirk and his people stand there, have I done?' It's a good moment—very

The work began with projected explosion model of the *Enterprise*—original, at least in the series. As with the previous two long model was the principal one used in it was built years before at Magicam by under the supervision of James Dow—I built it—and I've been shooting it for

